VOLUME 45
Fall 2012
http://gps.faa.gov

SatNavNews

FAA Navigation Services, AJM-321

First U.S. Ground Based Augmentation System (GBAS) Operational at Newark Airport

A milestone in the development of the Ground Based Augmentation System (GBAS) was reached on September 28, 2012 with the operational approval of the GBAS installed at Newark Liberty International Airport. This clears the way for United Airlines to initiate the first regular passenger flights in the United States using GBAS technology. United Airlines will primarily fly its GBAS Landing System (GLS)-capable Boeing 737-800 and 737-900 aircraft into Newark Liberty International. Another milestone was achieved when the first new United Boeing 787 (Dreamliner) also made its first GLS landing at Newark Liberty International Airport on October 10th, 2012.

The Newark GBAS is operated by the Port Authority of New York New Jersey (PANYNJ) as a non-Federal public navigation aid, which means PANYNJ has responsibility to maintain and operate the GBAS unit.

GBAS provides digital guidance for precision approaches using a Differential Global Positioning System (DGPS) for aircraft equipped with a Multi-Mode Receiver (MMR) or an Integrated Navigation Receiver (INR). The system boosts the accuracy and integrity of GPS by transmitting corrections to the aircraft.

The operational approval of the Honeywell's GBAS system (SmartPath SLS-4000) marks the successful completion of an industry initiated program to build and approve a ground based augmentation system. The Honeywell GBAS SmartPath system is approved for precision approach operations down to 200 feet (Category I precision approach).

The *SatNav News* is produced by the Navigation Services AJW-91 branch of the Federal Aviation Administration (FAA). This newsletter provides information on the Global Positioning System (GPS), the Wide Area Augmentation System (WAAS) and the Ground Based Augmentation System (GBAS).

Inside ...

Tell Us Your WAAS Story

We're collecting testimonials about the benefits of Wide Area Augmentation System (WAAS) navigation from users. If you are a pilot, passenger, airport manager, airline employee, or are involved in aviation in any capacity - whether you fly fixed-wing or vertical flight aircraft - we want to hear from you! Please send your stories and contact information to Scott Speed at scott.ctr.speed@faa.gov

Over the next few years, FAA GBAS research and development will focus on validating international requirements to guide an aircraft down to the runway surface to support zero-visibility operations (Category III precision approach). The strategy is to take the architecture that has been developed and approved for a single frequency GBAS CAT-I service and improve this architecture to provide CAT II/III service. Current CAT II/III planning focuses on reducing technical risk through prototyping and requirements validation. This approach is consistent with international GBAS efforts. GBAS standards for GAST-D, a service type equivalent to ILS CAT III, were baselined within an ICAO Navigation Systems Panel proposed amendment to the Annex 10 Standards and Recommended Practices (SARPS). The FAA has several activities in place to provide validation products as well as operational prototypes for cooperative testing.

- Dieter Guenter, FAA AJM-321/NAVTAC

GBAS Working Group Meeting 13 Held in Germany

Over 100 participants from 18 nations, international service providers, airlines, aircraft manufacturers, and other industry groups attended the 13th International GBAS Working Group (IGWG) on August 21-24, 2012, in Langen, Germany. Hosted by DFS, the German Air Navigation Service Provider at its headquarters, the meeting was chaired by the Federal Aviation Administration (FAA) and EUROCONTROL (John Warburton chairing for the FAA and Andreas Lipp for EUROCONTROL). The IGWG Secretaries attending were Dieter Guenter, FAA (NAVTAC), and Lendina Smaja, EUROCONTROL.

This meeting was special, as noted in the introduction by DFS CEO Dieter Kaden. It marks the world's first full operational implementation of a GBAS ground system, which was initiated by the DFS in Bremen, enables public GBAS Landing System (GLS) approaches to CAT I (200ft) decision height. Air Berlin has been flying these approaches since February, 2012. This ends a 12-year development/introduction phase and firmly places GLS in the short list of operational precision approach systems. This accomplishment will be closely followed by ongoing approval processes in Spain, Australia, the USA, and Russia with the expectation to have over 20 approved stations worldwide by end of 2013.

The national updates and briefings generally indicated increased activities in implementation of GBAS CAT I, but also for GBAS CAT II/III which are being driven in part by the Single European Sky ATM Research (SESAR) master plan activities and funding. All of the nations presented have GBAS related activities in one form or another from concept development and research prototype activities to actual implementation.

Boeing and Airbus remain committed to GLS and reported an increasing GLS customer base in spite of the economic slowdown.

The meeting exceeded the co-chairing organizations expectations and all participants were extremely satisfied with the outcome of the working group meeting. With a constant increase in number of contributions and participants, the I-GWG visibly fulfils a recognized function in GBAS implementation and its format seems well adapted to the participants' needs. This working group addresses relevant issues for the development and implementation of GBAS, and exchanges data and information, which can effectively be used by the participants in formulating their business strategies and implementation plans.

Another important development is that after a first set of telephone conferences on ionospheric aspects, several other subgroups agreed to continue working between meetings on identified actions and use web-based telecoms, technical/operational interchange meetings, and the public IGWG website (flygls.net). This coordination will include exchanging information on concept developments, test plans, and flight test to the point that mutual agreed to activities can be included in these national/organizational plans, where applicable.

- Dieter Guenter, FAA AJM-321/NAVTAC

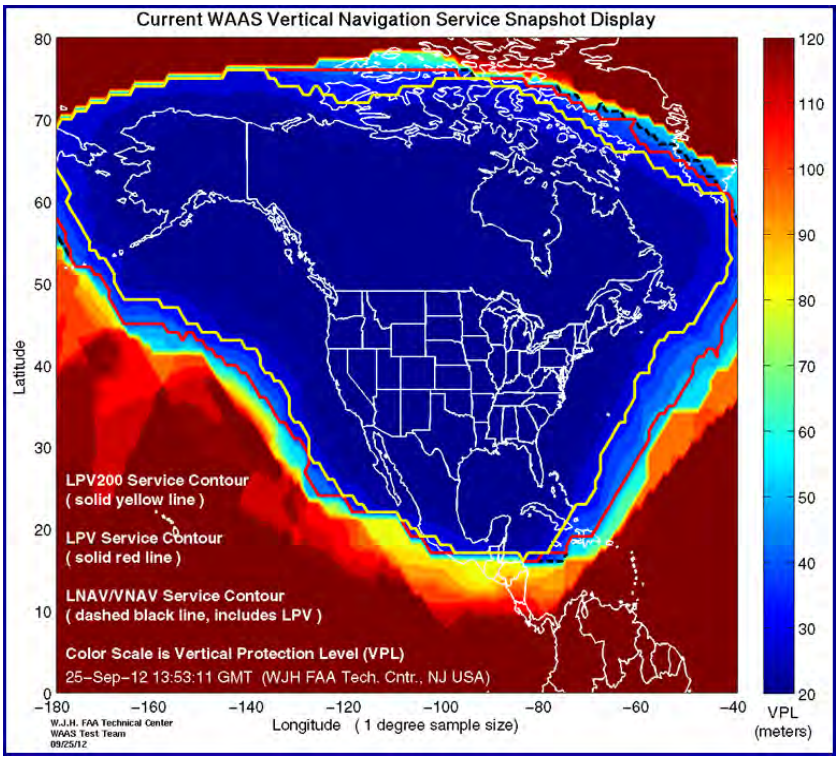
FAA and Mexico Collaborate on Expansion of WAAS

Collaborating under an international agreement, the Federal Aviation Administration (FAA), along with Servicios A La Navegación En El Espacio Aéreo Mexicano (SENEAM), and the Secretaria de Comunicaciones y Transportes Dirección General de Aeronáutica Civil de Mexico (DGAC), has begun implementing a joint US/Mexico Wide Area Augmentation System (WAAS) service by establishing WAAS infrastructure in Mexico.

The agreement, part of the over-arching Air Navigation Services Agreement between the FAA and SENEAM signed in May 2004, provides guidance for the implementation of WAAS service, the program schedule, Wide Area Reference Station and WAAS Communications Node implementation, WAAS circuit upgrades, the roles and responsibilities for operations and maintenance, Notice-to-Airmen (NOTAMS) for SENEAM, and the implementation of area navigation (RNAV) procedures within Mexican airspace.

Two main objectives of this international agreement are:

1. To expand, encourage, and support acceptance of WAAS; to promote accelerated equipage with WAAS avionics; and to directly support the safety of U.S.-flagged carriers already equipped with WAAS that currently operate in and out of Mexico
2. To provide support of the transition to Performance Based Navigation



North American WAAS Coverage September 25, 2012

Like Canada, Mexico's aviation system is a combination of private and government authorities. Private entity SENEAM is Mexico's air navigation service provider, responsible for the safe and efficient flow of air transportation in Mexican airspace, while the government agency DGAC provides regulatory services such as inspections and supervision of airport facilities, aircraft, and aviation staff. DGAC also monitors compliance with rules and regulations, identifies and eliminates acts, attitudes, and conditions that are hazardous, and investigates accidents and other incidents.

WAAS System Infrastructure Installation and Operation

The FAA has supplied loaned WAAS system equipment to Mexico, and the FAA and SENEAM have already installed the necessary WAAS Reference Station ground infrastructure in 5 locations in Mexico; Mexico City, Merida, Puerto Vallarta, San Jose Del Cabo, and Tapachula. Under the agreement, the FAA has provided logistics support and training of SENEAM personnel on the maintenance, security, and operation of WAAS equipment. The agreement also provides for periodic upgrades and the supply of replacement equipment when needed.

The current North American WAAS system network extending throughout Canada, the US, and Mexico provides the required coverage for all RNAV (GPS) approach minima, including Lateral Navigation (LNAV), LNAV and Vertical Navigation (LNAV/VNAV), Localizer Performance (LP), and Localizer Performance with Vertical guidance (LPV). All of North America and the northern part of Central America has coverage for LPV200 (200 foot decision height) as denoted in the coverage map below.

Operational Implementation - Development, Implementation, and Publication of RNAV Procedures

The FAA is supporting the development and publication of WAAS RNAV approach procedures at four selected airports in Mexico: La Paz, Monterrey, Cozumel, and Cancun. To support the operational implementation of RNAV approach procedures in Mexico, the FAA has provided support for the aeronautical surveys that are required before WAAS RNAV procedures can be designed and flight inspected. To date, the ground portion of these surveys has been completed with the data analysis and drawings being completed prior to submission to DGAC for review. DGAC will provide the data to SENEAM for RNAV procedure review and design.

The FAA will support the development, implementation, and publication of WAAS RNAV LPV approaches to the four airports by providing training as requested or required by SENEAM and DGAC in the following areas:

- GPS Satellite Navigation training program on DVD for Air Traffic Control
- Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS) - Principles of Area Navigation Approach Construction course will be provided by Mike Monroney Aeronautical Center personnel in Mexico City
- Flight Inspection Training Course based on FAA Order 8200.1C, U.S. Flight Inspection Manual, in Mexico City

DGAC has several of their Cessna Citation C-500 series flight inspection aircraft that are RNP certified which

DGAC Flight Inspection Aircraft

have also been upgraded with the required WAAS avionics.

The final piece of the WAAS system that will be implemented in Mexico is WAAS Notices to Airmen (NOTAM). In accordance with International Civil Aviation Organization (ICAO) guidance, aeronautical information must be issued to users and other providers when changes or limitations occur to the system to ensure the safe and efficient operation of WAAS. The FAA will assist SENEAM with acquiring and publishing WAAS NOTAM information appropriate for WAAS operations in Mexico.

- Don Porter, FAA AJM-321/NAVTAC

Contract Awarded for New WAAS GEO Satellite Service Lease

On September 24, 2012, the Federal Aviation Administration (FAA) awarded the Wide Area Augmentation System (WAAS) Geostationary Earth Orbit (GEO) Satellite Service Lease contract to Raytheon Company of Fullerton, California. Two GEO service lease(s) will be procured through this contract. The total contract value is $249.7 million. The GEO Satellite Service Lease is a critical component of WAAS operations, which generate data corrections for the GPS satellites and broadcasts the GPS-like Signal in Space (SIS) to WAAS users via the WAAS GEO Satellite Constellation.

The FAA must maintain a three-GEO satellite constellation and the six associated GEO Uplink Subsystems (GUSs). The current GEO satellite services have various leases which end between 2015 and 2017. The new WAAS GEO satellite(s) will enable the FAA to maintain the WAAS GEO Satellite Constellation and adhere to the GEO satellite sustainment strategy.

The GEO Satellite Service Lease contract consists of three phases. In Phase 1, the GSP located onboard the host GEO satellite is developed and launched while a corresponding pair of GUS are developed and fielded. In Phase 2, the GEO satellite and GUSs are integrated into the operational WAAS. Phase 3 begins once the integration is complete and the 10 year lease period starts.

- Scott Speed, FAA AJM-321/NAVTAC

WAAS Happening?

Are You Up to Speed on LPV Approaches?

When Mike Hall pilots his Mooney to his home airport in upstate New York, the Wide Area Augmentation System (WAAS) capability in his avionics display allows him to see and, with appropriate ATC clearance, join the RNAV (GPS) 32 instrument approach procedure when he is still around 30 miles from touchdown. Showing his location to an accuracy around eight feet on the terrain map generated by the installed database, the precision WAAS provides is the reason why nearly 60,000 aircraft, or around 60 percent of IFR capable general aviation aircraft fleet, are now equipped with WAAS-capable avionics.

As he closes in on Runway 32 at Ithaca Tompkins Regional Airport (KITH), Hall knows that the airport is equipped with both a conventional Instrument Landing System (ILS) and a WAAS-enhanced RNAV (GPS) approach that includes Localizer Performance with Vertical Guidance (LPV) minimums. Though minimums for the LPV are almost identical to those for the ILS, he almost always requests the LPV approach. As Hall observes, the LPV approach is just as accurate at 30 miles as it is over the runway threshold. ILS, by comparison, becomes less accurate as distance from the runway increases. Moreover, while ILS guidance can waver with any disruption to the ILS signal, LPV remains rock solid. Before the advent of LPV approaches at KITH, any ILS outage left pilots with few viable options in instrument meteorological conditions (IMC). As Hall observes, the only other approach to Runway 32 is a VOR procedure with minimums very close to those for VFR flight (1,400' ceiling). In an area plagued by winter snow and low visibility, having an out-of-service ILS meant Hall and his fellow pilots often had no luck getting into home base. Since he flies around 250 hours a year on business and personal trips, the LPV option is a very positive improvement.

Hall, a retired Air National Guard major general and F-16 fighter pilot who served in Operation Desert Storm, serves on the airport's governing body. He was an early advocate of getting LPV approaches developed and published for KITH, and notes that around 25 of the GA aircraft based at the field are now equipped to fly LPV approaches. These procedures can also benefit the two commuter carriers serving this airport once they equip their aircraft to do so.

Ithaca is not alone in enjoying the benefits of WAAS. The FAA has published more than 2,800 LPV approach procedures for use at nearly 1,400 airports since WAAS was enabled for operational use in 2003. The agency intends to publish another 2,500 procedures by 2016, which will allow every runway in the nation that qualifies for an LPV to have one. Of these 2,800 approach procedures, over 50 percent are published at airports that lack a groundbased ILS system. In fact, some of these airports don't have any approach procedures using ground based navigation

aids. That's another reason that LPV procedures are such a big hit with pilots, says Heidi Williams, vice president of Air Traffic Services and Modernization for the Aircraft Owners and Pilots Association (AOPA). "Our members embrace GPS and area navigation (RNAV), including WAAS, due to their benefits," she adds.

Another fan of LPV is Max Trescott, CFI and aviation educator/author who teaches pilots in Silicon Valley how to fly LPV approaches in their high-performance single and twin engine aircraft with glass cockpits. Trescott logs about 500 hours a year in instruction time and has written several books on today's avionics to fly LPV approaches. Trescott focuses on training pilots to properly set up the GPS avionics for an LPV approach because, as he and Hall both observe, it's just like flying an ILS after that. And just like Hall and his fellow pilots in New York, Trescott's California clients have benefited immensely from WAAS capability. For instance, Half Moon Bay Airport (KHAF), located near a Pacific Ocean beach in San Mateo County, was often inaccessible using non-precision approach procedures because cloud bases at 800 to 1,000 feet often restricted access to the airport. With the new LPV approaches, however, aircraft can easily fly into Half Moon Bay on cloudy days. Trescott also notes that LPV has made Reid-Hillview Airport (KRHV), a reliever for San Jose International Airport, more accessible.

If you're not familiar with WAAS-enabled approaches, including those with LPV minimums, it's a great option. Try it — you'll like it!

- By David Hughes, reprinted from FAA Safety Briefing, September/October 2012

FYI: PNT.gov Merged into GPS.gov

Last year, the White House directed all agencies to consolidate and eliminate duplicative federal websites.

As a result, the responsible federal agencies have decided to merge PNT.gov into GPS.gov and eliminate the public PNT.gov website.

Starting today, all info about the PNT policy, EXCOM, member agencies, and the National Coordination Office (NCO, which is the permanent staff of the National Executive Committee for Space-Based Positioning, Navigation, and Timing) can now be found at:

http://www.gps.gov/governance/

Please update any bookmarks or web links you have pointing to PNT.gov

What's New on the Web!

GNSS Mobile Website Update – Thanks to all for the positive feedback provided in response to our request in the recent Summer edition of the SATNAV News to check out our new GNSS mobile website. We were excited to receive your comments and have already implemented a few enhancements. Please be sure to check out the updates. Also, if you have not already done so, please don't forget to add the GNSS Mobile Website icon to the home screen of your phone so that you always have quick and easy access to the latest FAA GNSS Information. Please visit our mobile site at http://gps.faa.gov/mobile

Just type http://gps.faa.gov into any web browser to access the best and most accurate information available from the FAA's Navigation Services Global Navigation Satellite System (GNSS) website.

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Satellite Navigation Approach Procedures Update - LPVs/LPs Exceed 3300

September 20, 2012 – The number of Wide Area Augmentation System (WAAS)-enabled approach procedures continues to increase. Earlier this year, the number of LPVs and LPs , combined, surpassed 3300!

The tables shown here reflect the latest numbers. More information about WAAS approach procedures can be found on our GNSS - GPS/WAAS Approaches web page (http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/approaches/index.cfm).

- Mary Ann Davis, FAA AJM-321/NAVTAC

Satellite-based Approach Procedures (by Procedure Type)

	Procedures (Part 139 Airports)	Procedures (Non-Part 139 Airports)	Total Number of Procedures
LNAV Procedures	1766	3786	5562
LNAV/VNAV Procedures	1256	1575	2876
LPV Procedures *(LPV w/200' HAT)*	1297	1692	2989 *(717)*
LP Procedures	49	333	382
GPS Stand-Alone Procedures	17	181	198

Note: Number of GPS Stand-Alone will continue to decrease as they are replaced by RNAV procedures
(Data as of September 2012)

Instrumentation Approach Procedures (IAPs) Based on Traditional Navaids

ILS	1,279
ILS (CAT II)	160
ILS (CAT III)	112
NDB	836
VOR	1,308
VOR / DME	968

(Data as of September 20, 2012)

Table truncated for publication. Full table available at Instrument Flight Procedures (IFP) Inventory Summary